

A Methodology Using Biosimulants to Describe Non-Lethal Weapon Effects on People

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Abstract

The response of biological systems exposed to Non-Lethal Weapons (NLW) is not well understood. The literature contains predominately anecdotal references to effects that have not been systematically studied and are subject to ambiguous interpretation. Without a clear understanding of the mechanisms by which the device effects couple to the target and evoke response modes of interest, there is no way to extrapolate the results of animal experiments to humans. In particular, for devices which radiate mechanical waves through the body, such as High Power Acoustic Beam Weapons (HPABWs), non-penetrating projectiles, and toroidal vortices; differences between humans and animals with respect to tissue properties, organ and cavity geometry, elastic properties of connective tissue, and frequency response of specific anatomical structures, strongly suggest that there will not be an obvious correspondence between response modes evoked in animals and humans.

Our approach analyzes conventional trauma databases to identify regions of the human body that may be susceptible to NLW effects and response thresholds that can evoke desired effects. Once the pathogenesis of a potential effect has been identified, experiments using insitu instrumentation and biosimulants configured to mimic relevant anatomic features are implemented. These experiments support development of analytical models that describe the physics of the interaction and which can ultimately be extrapolated to biological systems.

MRC has successfully applied various aspects of the proposed methodology to its ongoing DARPA/MRDC sponsored Simulation and Assessment of Musculoskeletal Trauma from Penetrating Wounds program (DAMD17-94-C-4099) and its DLA/DARPA/NRaD/MRC Sensate Liner Development for Combat Casualty Care program (N66001-96-C8641).